ENTEROSORPTION THERAPY PROVIDED BY CALIBRIN®-Z ENTEROSORBENT AFTER PIGS WERE INTOXICATED BY ZEARALENONE

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ABSTRACT

Zearalenone (ZEA) is a mycotoxin produced by *Fusarium* fungi. Its estrogenic effects cause infertility, abortion and other breeding problems, especially in swine. The excretion of absorbed ZEA and its metabolites are mainly through bile from liver and they can be re-absorbed via enterohepatic circulation. Calibrin-Z (CAZ) is a highly-refined montmorillonite sorbent mineral that has high affinity and capacity to sequester a wide range mycotoxins found in feed grains. CAZ has been shown to prevent dietary ZEA absorption in pigs. However, it has not been demonstrated to prevent ZEA and its metabolites re-absorption in the small intestine. Therefore, the objective of current study was to evaluate the effect of CAZ feeding after pigs were intoxicated by pre-fed different levels of ZEA. A total of 64 female pigs were fed 0, 200, 400, or 800 ppb of cultured ZEA (provided by University of Missouri, Columbia) contaminated diets for 28 d prior to the start of the current study. Sixteen pigs from each pre-fed ZEA treatment were randomly divided into half (4 replicate pens with 2 pigs each) and fed either a control diet (no detectable mycotoxins) or control + 0.2% CAZ for 18 d to form 8 treatments in a 4 x 2 factorial arrangement. Vulva size was measured at 3 d intervals. Blood samples were collected on d-9 and d-18; serum malondialdehyde (MDA), superoxide dismutase (SOD), and liver enzymes such as aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (AP) were analyzed. Pigs previously fed diets containing ZEA at 400 and 800 ppb had reduced ($P < 0.05$) ADG in the post-ZEA period compared with pigs previously fed a non-ZEA diet. Supplementation with 0.2% CAZ increased ($P < 0.05$) ADG in pigs pre-fed 200 (651 vs. 734 g), 400 (615 vs. 686 g), or 800 (617 vs. 690 g) ppb ZEA diets as compared with the pigs pre-fed the same ZEA diets. However, improved FE ($P < 0.05$) from CAZ feeding was observed in pigs pre-fed the 400 (757 vs. 832) ppb treatments, only. Pigs fed 0.2% CAZ reduced ($P < 0.05$) average vulva size through-out the 18 d period as compared with those pigs fed the control diet regardless of pre-fed ZEA dosage. The rate of vulva size reduction was significantly improved in pigs fed the CAZ diet, over those fed the control diet. Serum MDA was reduced ($P < 0.05$) in pigs fed CAZ supplementation on d-18 but not different on d-9; SOD increased ($P < 0.05$) in those pigs fed CAZ on d-9 but not different on d-18. In general, serum liver enzymes were not different between control and CAZ feeding, except the AP was lower ($P < 0.05$) in pigs pre-fed 800 ppb ZEA and continued on the control diet. The results suggested that Calibrin-Z may increase detoxification of ZEA in pigs possibly by preventing re-absorption of ZEA and its metabolites in the small intestine originating from bile (enterohepatic circulation); and it may be used to accelerate the recovery from ZEA intoxicated pigs.

OBJECTIVE

The objective of this study was to evaluate the effects of Calibrin-Z enterosorbent (a mineral sorbent) after pigs were intoxicated by pre-feeding low concentrations of zearalenone (ZEA) for 28 days.

MATERIALS & METHODS

Animals

64 gilts (L×Y×D) ; BW (27.13 ± 1.39 kg)

Period

28 d pre-feeding of 0, 200, 400, or 800 µg/kg ZEA; followed by 18 d feeding of mycotoxin free diets with or without Calibrin-Z.

Sixteen pigs from each pre-fed ZEA treatment were randomly divided into half (4 pens of 2 pigs each) and fed either a control diet (no detectable mycotoxins) or control + 0.2% Calibrin-Z for 18 d to form 8 treatments in a 4 x 2 factorial arrangement

Pre-fed (28 d)	ZEA, µg/kg							
	0		200		400		800	
Calibrin-Z, % (18 d)	0	0.2	0	0.2	0	0.2	0	0.2

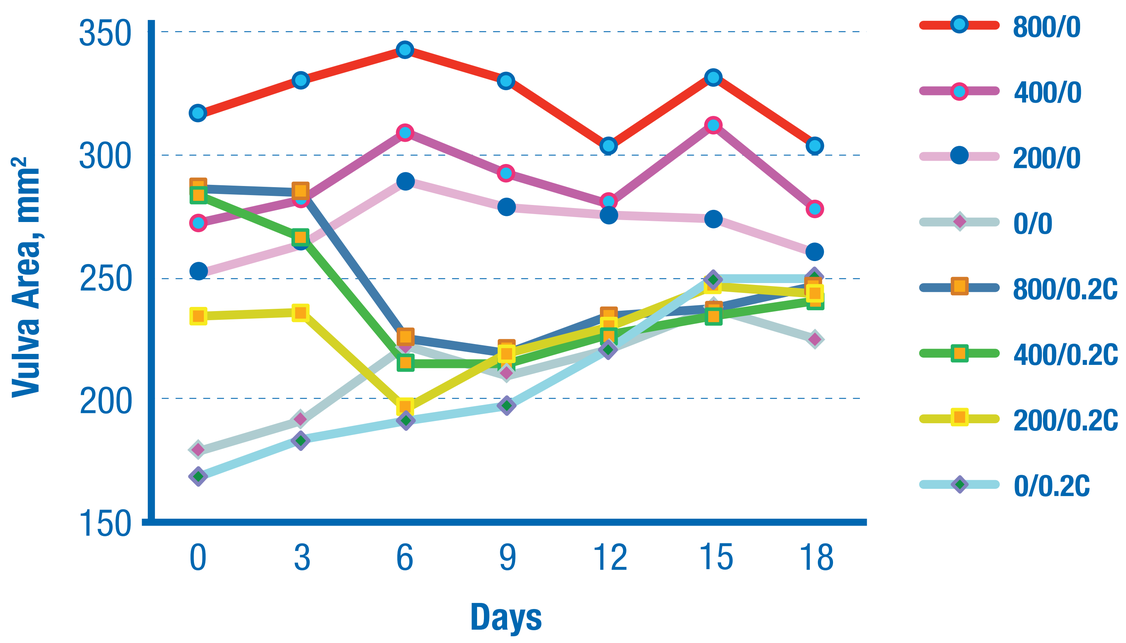
RESULTS

TABLE 1. Effects of Calibrin-Z on growth performance, vulva size, and oxidative stress in zearalenone intoxicated gilts

ZEA[1], µg/kg	0		200		400		800		SE	*P* value
Calibrin-Z, %	0	0.2	0.2	0	0.2	0	0.2	0		
Growth Performance										
ADG, g	672^{bc}	680^{ab}	651^{bc}	734^{a}	615^{c}	686^{ab}	617^{c}	690^{ab}	18	0.04
ADFI, g	809^{abc}	815^{abc}	819^{abc}	868^{a}	757^{c}	832^{ab}	782^{bc}	820^{abc}	20	0.05
G : F	0.830^{abc}	0.839^{abc}	0.794^{bc}	0.847^{a}	0.813^{abc}	0.826^{abc}	0.791^{c}	0.844^{ab}	0.016	0.02
Vulva Size										
Width, mm	19.18^{c}	19.17^{c}	21.09^{bc}	19.72^{c}	22.26^{ab}	20.10^{c}	23.39^{a}	20.09^{c}	0.61	0.04
Length, mm	22.70^{c}	22.35^{c}	25.92^{ab}	23.14^{c}	26.25^{ab}	23.12^{c}	27.52^{a}	23.96^{bc}	0.78	0.05
Area, mm^2	217.52^{d}	214.01^{d}	273.27^{bc}	229.17^{d}	292.16^{ab}	232.26^{d}	321.88^{a}	242.37^{cd}	12.43	0.05
Superoxide Dismutase (SOD), U/L										
9 d	**4.94^{a}**	**4.56^{a}**	**3.80^{b}**	**4.45^{a}**	**3.70^{b}**	**4.63^{a}**	**3.51^{b}**	**4.76^{a}**	0.21	0.04
18 d	3.86	4.51	4.61	4.02	4.58	4.58	4.56	4.22	0.23	0.31
Malondialdehyde (MDA), U/L										
9 d	2.2	2.46	1.83	2.26	1.64	2.24	1.32	2.2	0.22	0.49
18 d	**1.57^{c}**	**1.83^{bc}**	**2.14^{b}**	**1.92^{bc}**	**3.23^{a}**	**1.92^{bc}**	**3.44^{a}**	**2.01^{bc}**	0.18	0.02

[1]ZEA was pre-fed for 28 days prior to feeding of clay.

FIGURE 1. Effect of Calibrin-Z on vulva size in zearalenone intoxicated gilts



CONCLUSIONS

Feeding Calibrin-Z to zearalenone intoxicated gilts:

- Improved ADG, ADFI, and G : F
- Reduced vulva sizes and reduced vulva sizes quickly
- Reduced oxidative stress by Increasing SOD activity and reducing MDA in serum

IMPLICATION

Feeding Calibrin-Z may reduce ZEA half-life by preventing ZEA metabolites reabsorption via enterohepatic circulation; therefore, the clinical symptom of enlarged vulva was significantly reduced faster over time.